Appendix A Case Studies

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1.0 Introduction

This Appendix describes several case studies that illustrate approaches for conducting the types of analyses described in this volume. First, presented in Section 2 is an application of EPA's RAIMI approach in Port Neches, Texas, that illustrates a cumulative multisource assessment (Part II of this volume). Following this in Section 3 is a brief description of a similar air quality modeling case study conducted for Houston, Texas. In Section 4, the Cleveland Clean Air Century Campaign is summarized as an illustration of how a community can take action to identify and reduce exposures to toxics from a variety of sources (Part IV of this volume). Brief summaries of three additional examples of community action toward identifying and reducing air toxics exposures are presented in the final section.

2.0 Application of RAIMI in Port Neches, Texas

EPA Region 6 developed the Regional Air Impact Modeling Initiative (RAIMI) as a technical approach that utilizes existing guidance and tools to evaluate the potential for health impacts as a result of exposure to emissions from multiple sources. The RAIMI approach employs a methodology that allows the user to systematically and efficiently conduct a localized assessment that covers the "big picture" of risk for a community from sources of air toxics, rather than an analysis focusing on a single (or very limited number of) emission sources.

Port Neches: An Example Application of the RAIMI Methodology

The Port Neches Case Study described in this appendix describes the application of RAIMI as a methodology for performing localized cumulative multisource assessment. The primary interests and goals of an assessment will differ from community to community, so the exact methodology used should depend on and be tailored to local circumstances. As always, the needs of the community in terms of the assessment's purpose, scope, and methodology must be well defined to produce useful results. In addition, this case study reflects the application of RAIMI at Port Neches as a "pilot study" of the methodology; some details related to the application of RAIMI have changed since the pilot study, and other aspects of RAIMI may be modified in the future as the methodology evolves and is improved.

The EPA Region 6's pilot study of the RAIMI approach was performed in the community of Port Neches, Jefferson County, Texas because the area exhibited the source characteristics, receptor characteristics, and other practical considerations that were deemed desirable for an optimal pilot study area. The information provided below is a summary of the pilot study. More detailed information about RAIMI, including a full description of the Port Neches case study, can be obtained on EPA's web page at http://www.epa.gov/earth1r6/6pd/rcra_c/raimi/raimi.htm.

Jefferson County is located in southeast Texas on the gulf coast and is bounded to the east by the Neches River and to the south by the Gulf of Mexico. Jefferson County has a population of 241,322, according to 1999 census estimates.[1] There are two main urban areas in the county, both of which are included in the Beaumont-Port Arthur Metropolitan Statistical Area. The City of Beaumont is located in the north-central part of the county, and has a population of 109,697, based on 1999 census estimates.[2] The second urban area is located about 20 kilometers southeast of Beaumont, and includes the cities of Port Arthur (1999 estimated population 56,574), Port Neches (13,981), Nederland (17,599), and Groves (16,362).[3] Numerous local industrial complexes are interspersed with surrounding residential and commercial areas of single and multi-family dwellings, including schools, parks, child and elderly care centers, and hospitals. A significant portion of Jefferson County land area, mostly in the west half of the county, is comprised of undeveloped, rural, and agricultural land use.

Jefferson County, Texas

The Port Neches Assessment Area is located south of Beaumont and north of Port Arthur, centered among the cities of Port Neches, Groves, and Nederland. The Port Neches Assessment Area covers an area 23 kilometers west to east and 12 kilometers south to north (276 sq. km.). The area is characterized by several large industrial facilities located within Port Neches, Groves, and Nederland, in close proximity to several residential neighborhoods (Exhibit A-1).

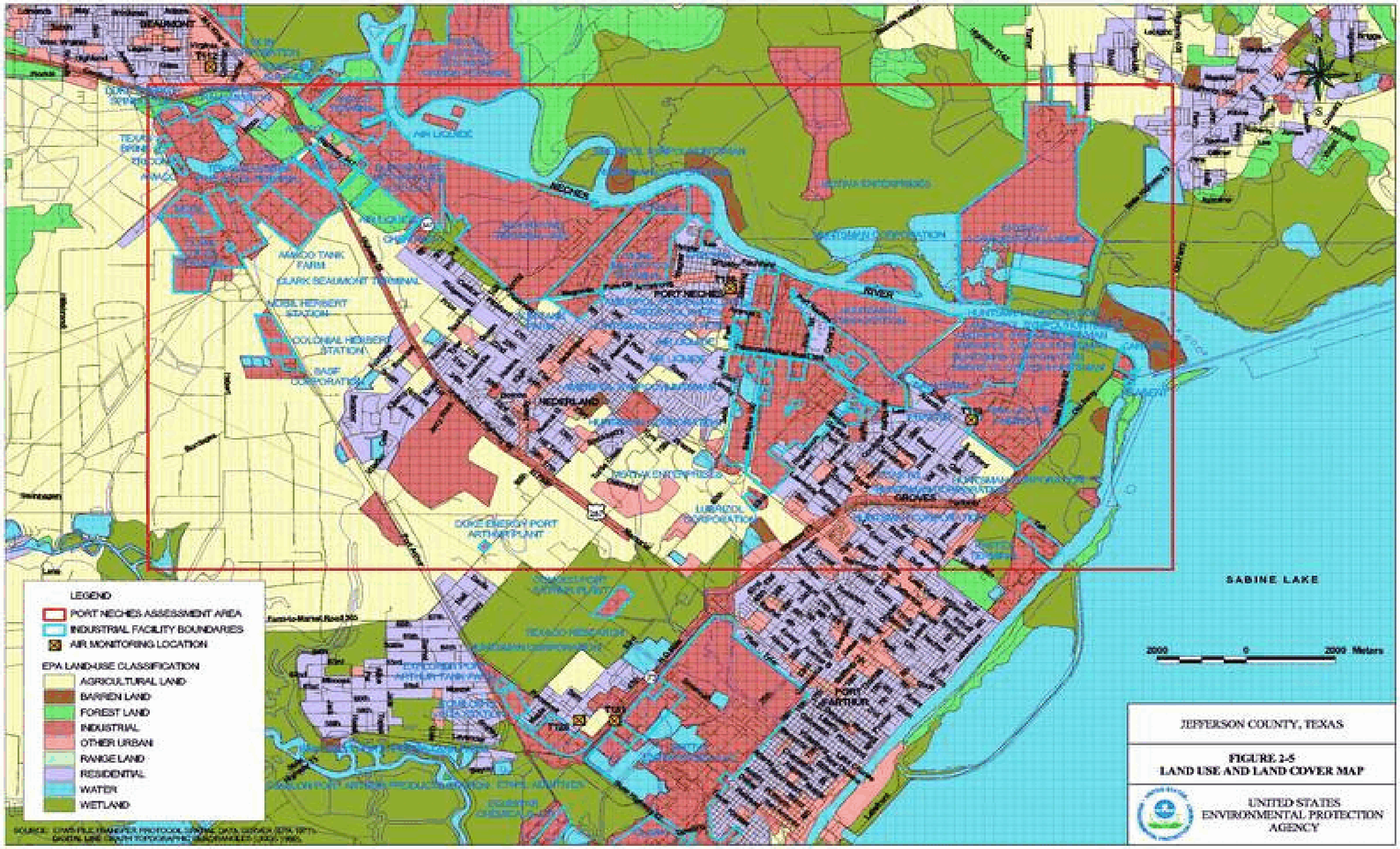
For the pilot study, EPA followed the basic procedure for multisource assessment presented in this resource document, by characterizing air toxics sources within the study area, modeling air concentrations, and calculating cancer risks and non-cancer hazards for residents in the study area. Overall, the Port Neches Pilot Study was a successful test of the capabilities of the RAIMI as a tool for use in risk-based multisource assessments. The study was effective in providing site-specific ranking of risk concerns, as well as identification of important data gaps. In addition, the pilot identified the need for more robust analytical and data management capabilities to conduct large scale and high-resolution multisource assessments, which has been the primary focus of RAIMI developers in the follow-up to the Port Neches Phase study (a Phase II study) and county-wide RAIMI Screen assessments.

2.1 Planning, Scoping and Problem Formulation

EPA conducted the Pilot Study primarily to test – in a "real-life" situation – the practical utility of RAIMI as a technical tool for examining and ranking the potential impacts of multiple emission sources on a localized scale. The Pilot Study was also designed to provide useful, site-specific risk results that could be used to determine potential health risks and (if appropriate) inform local risk management decisions.

With these objectives in mind, EPA carried out the planning, scoping, and problem formulation phase of the study to set the bounds of the assessment and establish a way to focus their resources. The Jefferson County, Texas, area was first subdivided into five separate zones based on density of emission sources and the presence of neighborhoods and people. One of these assessment areas, Port Neches, was then selected as the specific study area for the Pilot Study because it contains various air toxics sources (including local industrial complexes and non-industrial sources) interspersed with residences and neighborhoods both directly adjacent to and more distant from the major industrial sources. The study area is large enough to support a diversity of sources and receptors without being so large as to be burdensome for data collection and analysis.

Exhibit A-1. Land Use and Land Cover in Port Neches Study Area



EPA specified that the assessment would focus on both cancer risks and non-cancer hazards from direct human inhalation exposures (a later phase of the RAIMI Pilot Study may address multipathway exposures). Only releases of contaminants to outside air were considered, and ambient concentrations were predicted using an air dispersion model. EPA also confirmed that several readily-available and relevant emissions inventory data sources were available for this area. Risks would be calculated for people in Port Neches with estimated average annual ambient concentrations used as a surrogate for chronic exposure (i.e., with no exposure model used), with several years of data considered to account for temporal variability.

2.2 Emissions Characterization

Once the problem formulation was completed, EPA identified relevant emissions sources within the study area and collected necessary data on source and emission specific parameters for air dispersion and risk modeling. As an initial step, the source types of interest were defined for the purposes of ISCST3 air dispersion modeling (for this study, stack, fugitive, and mobile sources), and the source-specific emissions data to be collected for each of these source types were specified (e.g., stack height, release location, emission rate; see Exhibit A-2). This up-front analysis helped to focus EPA's data collection and processing efforts.

A variety of federal and state emission data sources were evaluated for their potential utility for the case study. Two primary data sources were selected (Exhibit A-3). The Texas Natural Resource Conservation Commission (TNRCC) Point-Source Database (PSDB) was used for individual emission sources (e.g., industrial facilities), and the National Emissions Inventory (NEI) was used for grouped emission sources (e.g., gas stations, dry cleaners, mobile sources, and other sources, where overall emissions across the study area have been estimated and aggregated). Information from these two data sources was supplemented by additional data from EPA's Toxics Release Inventory (TRI) and other federal and state data files for specific emissions sources.

To carry out the assessment rapidly and efficiently, emission sources were prioritized before moving on to more in-depth assessment, allowing EPA to focus resources on the most significant emission sources in terms of the potential to impact neighborhood receptors in the Port Neches area. Different prioritization schemes were employed for individual and grouped emission sources.

- About 1,529 **individual emission sources** were identified in the TNRCC PSDB for the Port Neches Assessment Area; therefore, modeling every source would have been extremely resource-intensive. Individual emission sources were prioritized first on the basis of total mass emitted annually. Specifically, only those sources reporting emissions of at least 1 ton of a speciated contaminant were carried on to the next step of the assessment (i.e., about 113 of the 1,529 original sources).[a]

[a] Analysts should use caution when screening out persistent chemicals that bioaccumulate or biomagnify since relatively small emissions may lead to high levels in non-air media, such as biota, over time.

Exhibit A-2. Source-Specific Emissions Data Needs for ISCST3 Air Dispersion Model Input			
	Stack Source	**Fugitive Source**	**Mobile Source**
Physical Characteristics	Stack height [m] Base elevation [m] Stack diameter [m] Stack gas exit velocity [m/s] Stack gas exit temp. [K] Control device description Location [NAD 83]	Area [m^2] Release height [m] Base elevation [m] Location [NAD-83]	Area [m^2] Release height [m] Base elevation [m] Location [NAD-83]
Emissions Characteristics	Contaminant CAS number and name Speciated emission rate [g/s]	Contaminant CAS number and name Speciated emission rate [g/s]	Contaminant CAS number and name Speciated emission rate [g/s]
Notes: m meters m/s meters/second K Kelvin NAD-83 North American Datum 1983 g/s grams/second CAS Chemical Abstract Service			

Exhibit A-3. Potential Sources of Emissions Information for Port Neches Assessment		
Source	**Maintained/ Administered By**	**Data Characteristics**
National Emissions Inventory (NEI)	EPA	Digital
Toxic Release Inventory	EPA	Digital
Aerometric Information Retrieval System (AIRS)	EPA	Digital
RCRA Hazardous Waste Permit Files	EPA and TNRCC	Hard copy
RCRA Information System	EPA	Digital
Point-Source Database	TNRCC	Digital
New Source Review Permit Files	TNRCC	Hard copy
Title V Permit Applications Table 1-A forms	TNRCC	Hard copy
Facility files and records	Facility	Unknown

- Data from the NEI for **grouped emission sources** indicated that there were about 74 subcategories of these sources for the Port Neches area. To prioritize these subcategories, a worst-case hypothetical emissions scenario was used as a basis for screening. Under this scenario, all emissions (county-wide totals) for a given subcategory were assumed to occur in the geographically smallest census tract in the Port Neches area, thereby generally resulting in a situation with the highest possible density of emissions and receptors. "Pseudo-point source locations" were used as the release points for grouped emission sources to simulate their emissions throughout the census tract.[(b)] Air and risk modeling were then conducted (following the procedures described in the next sections) to determine which source subcategories exceed certain risk and hazard prioritization levels. This resulted in 42 subcategories of grouped emission sources that were carried on through more refined air and risk modeling, in which county-wide emissions were allocated to census tracts using an appropriate allocation scheme (e.g., based on land use, population, SIC employment).

2.3 Air Dispersion Modeling

For the air quality modeling phase of the Port Neches assessment, EPA used the ISCST3 air dispersion model. (Note that the RAIMI technical approach allows for the use of a range of models.) Five years of meteorology data representative of the Port Neches area were obtained for the modeling to account for year to year variability in weather patterns. A receptor grid (i.e., the specific points in space where ambient concentration of air toxics are estimated by the dispersion model) was designed with 500-meter intervals between grid points to cover the entire study area (Exhibit A-4). In addition, for five areas of high industrial activity (those with numerous emissions sources and nearby residential areas), a denser grid using 100-meter spacing was used to provide more refined results in these areas (Exhibit A-5).

[(b)] For grouped emission sources, "pseudo-points" were located at the geographic center of the census tract and at the four main compass point directions (north, east, south, west) at a distance of one-half the radius of a circle with an area equivalent to the census tract. Emissions were then allocated to these locations, with one-ninth of the total emissions assigned to the center point and two-ninths assigned to each of the surrounding sources.

Exhibit A-4. Receptor Grid and Node Array Map for Port Neches Assessment Area

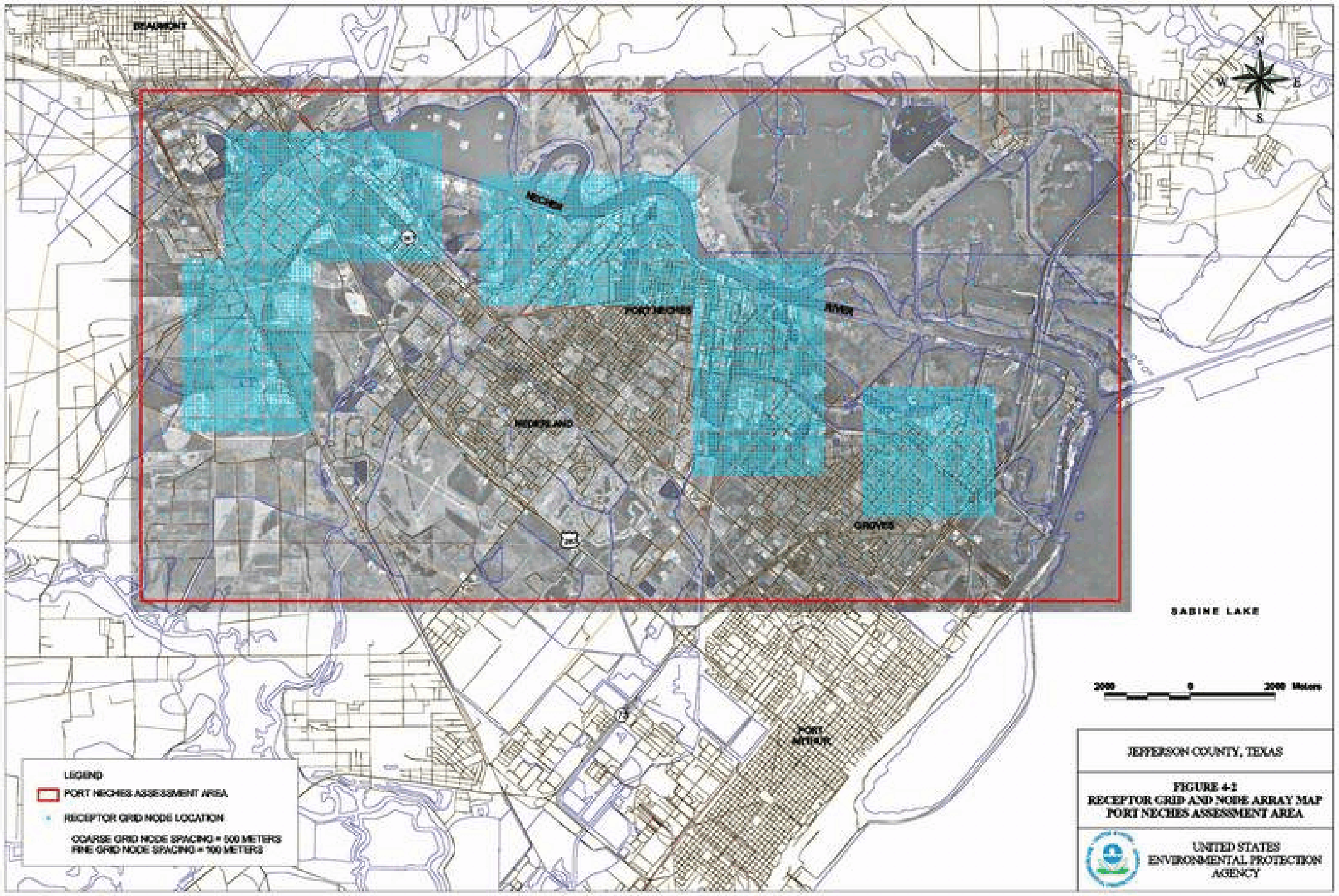


Exhibit A-5. Grid Node Array Areas for Port Neches Assessment Area [a]						
Grid Name	**Spacing**	**Minimum UTM X (m)**	**Maximum UTM X (m)**	**Minimum UTM Y (m)**	**Maximum UTM Y (m)**	**Dimensions (km)**
395-3311	500-meter	395,000	418,000	3,311,000	3,323,000	23 x 12
397-3319	100-meter	397,000	402,000	3,319,000	3,322,000	5 x 3
403-3318	100-meter	403,000	408,000	3,318,000	3,321,000	5 x 3
408-3314	100-meter	408,000	411,000	3,314,000	3,319,000	3 x 5
412-3313	100-meter	412,000	415,000	3,313,000	3,316,000	3 x 3
396-3315	100-meter	396,000	399,000	3,315,000	3,319,000	3 x 4

[a] For this application, the Universal Transverse Mercator (UTM) coordinate system was used to define the grid node locations. Refer to Section 5.2.4.3 for a description of the UTM system.

To generate adequate and useful results, minimize the production of unnecessary data, and accommodate the flexible design of site-specific risk evaluation, a "single-pass" air modeling approach was used in the Pilot Study. In this approach, each source and each potential contaminant phase (e.g., vapor, particle) from that source are modeled individually (i.e., 2,500 sources take 2,500 model runs). Emissions from each source are modeled at a unitized emission rate (e.g., 1 gram/second). Every model run is source-specific (i.e., weather is source-specific, using regional weather station data modified for each source location by local surface roughness determined by land use surrounding the source). The set of air concentration and deposition estimates that are completed using a unitized emission rate can then be adjusted to actual source and contaminant specific air concentrations and deposition rates by multiplying the concentration found in the unitized analysis by the actual emission rate of each contaminant from each source. Because each source is modeled to a Universal Grid of points, the estimated air concentration and deposition values at each modeling point (also referred to a receptor location or "node") for each source and contaminant can be summed across all of the modeling runs to provide exposure concentrations for that location. The single-pass approach has the following advantages:

- Updated or revised emissions data can be readily incorporated into analysis and new exposure concentrations determined without re-air modeling (i.e., if more refined or additional emissions data are obtained during the study, or at some point after the study). Unitizing the emission rates allows the air dispersion modeling analysis to be done only once for a source. Since air dispersion modeling is a computer intensive step, having the ability to model each source only once saves a great deal of time when modeling a large number of sources, as is typically found in community-scale assessments.

- The potential impact on estimated exposures and risks from reducing (or increasing) emissions from one or more sources can be assessed by multiplying the modeled air concentration estimates by the new emissions rates.

The end result is a scalable set of model results that can be used for current and future anticipated risk modeling needs (i.e., "what if" scenario evaluation, evaluation of pollution control measures). Key results of air quality modeling for the Port Neches case study included estimated air concentrations for both vapor and particle phases.

2.4 Exposure Assessment and Risk Characterization

The risk modeling component of the RAIMI estimates potential human health exposures at the neighborhood level by using a relatively simple inhalation exposure scenario in conjunction with the modeled air concentrations. Specifically, the case study used estimated ambient air concentrations as surrogates for the exposure concentration (EC). Estimated ambient air concentrations were then combined with toxicity factors to develop estimates of chronic cancer risk and hazard. Because an exposure model was not used in this study, the risk results are necessarily screening-level estimates of risk.

As noted above, an exposure model could have been applied to further refine the exposure assessment (using different microenvironments) and resulting risk and hazard estimates. Volume 1, Chapter 11 provides a more detailed discussion of available approaches for developing refined estimates of exposure.

Exposure and risk modeling for the Port Neches study generally followed the guidance presented in EPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (HHRAP).[(4)] Although the HHRAP was initially developed for the assessment of a single combustion facility, it can be applied in a multi-source assessment, and it met the goals of the Port Neches Pilot Study at the time the study was performed. Exposure and risk calculations and analyses were carried out with the assistance of several software applications, including ACCESS™ database software (Microsoft Corporation) for doing the bulk of the computations, IRAP-*h* View™ risk modeling software (Lakes Environmental Software, Inc.) for tabulating results, and a GIS platform utilizing ArcView™ software (Environmental Systems Research Institute, Inc.) for spatial analyses. (Note that all of these functions have now been automated within the current RAIMI software suite - see Chapters 5 and 6.)

A Note on the RAIMI Port Neches Case Study

Assessors should note that the original case study materials for the Port Neches area provided on the RAIMI website indicate that inhalation exposure scenarios and risk calculation approaches (including selection of toxicity values) were used that may differ from those recommended by Volume 1 of this series. As such, this case study should be considered an example of only the concept of how to perform a cumulative multisource assessment. When performing an actual assessment in a community, EPA recommends that assessors follow the guidelines for inhalation exposure assessment and risk calculations as provided in ATRA Volume 1. While the RAIMI software has subsequently been modified to match the recommended risk calculation approaches recommended in ATRA Volume 1, the toxicity values in the RAIMI software currently do not match those recommended in ATRA Volume 1. Analysts can modify the toxicity values for a given RAIMI software run as needed to match the current recommended EPA values.

These tools provided semi-automated methods for importing the air modeling results from ISCST3 output files, calculating risks at receptor locations from multiple sources and chemicals, performing additional iterations (e.g., to re-evaluate risks for different inputs), and graphically displaying risk results. Inputs needed for the ISCST3 model included speciated emission rates for each emission source, fate and transport parameters for each exposure location, and chemical-specific properties (see Exhibit A-6). Toxicity factors were obtained from EPA's IRIS database and other sources. This setup allowed EPA to calculate cancer risks and hazards for individuals and populations in the Port Neches study area.

2.5 Presentation of Results

To develop the risk results of interest, information on land-use (residential, commercial, etc.) was combined with the basic risk modeling results to identify the neighborhoods with the highest potential risks. Two distinct residential neighborhoods – the Port Neches/Nederland and Groves neighborhoods – were identified as the exposure areas with the highest cancer risks and hazards, taking into account where people are located and population density. The results were further analyzed to identify the chemicals (i.e., risk drivers) and sources (including both industrial facilities and categories of mobile sources) responsible for the largest part of the estimated cancer risks and hazards. Maps and tables were created to display where and how high modeled risk levels were predicted to be within these modeling domains. For example, Exhibit A-7 presents a summary table of average risk estimates for the Nederland neighborhood. Exhibit A-8 presents a summary graphic displaying isopleths of areas where risk estimates were within specified ranges. Exhibit A-9 presents and example of how to display the results of a source apportionment analysis. Exhibits A-10 and A-11 illustrate examples of how to use the results of source apportionment analyses to support risk management decisions (refer to the text box below for a more detailed description of the examples presented in Exhibits A-9 through A-11). Similar tables were generated to show risks for the Groves neighborhood. In addition, EPA developed an evaluation of uncertainties affecting the results of the Pilot Study. Finally, EPA summarized how the results of the RAIMI Pilot Study could be useful to regulatory agencies and facilities in identifying and prioritizing risk management opportunities.

Overall, the Port Neches Pilot Study was a successful test of the capabilities of the RAIMI as a tool for use in cumulative multisource assessment. In addition, the study was effective in providing site-specific prioritization of risk concerns, as well as identification of important data gaps. Complete documentation of the Pilot Study is available at the RAIMI website (http://www.epa.gov/earth1r6/6pd/rcra_c/raimi/raimi.htm).

Exhibit A-6. Air Modeling Input Parameter Values for Port Neches Study		
Parameter Description	**Units**	**Value**
Met preprocessor: Surface station	--	Jefferson County Airport, TX (WBAN 12917)
Met preprocessor: Upper air station	--	Lake Charles, LA (WBAN 03937)
Met preprocessor: Years selected	yr	1984, 1985, 1988, 1989, 1990
Met preprocessor: Minimum M-O Length	m	2.0
Met preprocessor: Surface roughness length (measurement site)	m	0.10
Met preprocessor: Surface roughness length (application site)	m	1.0
Met preprocessor: Noontime albedo	--	0.18
Met preprocessor: Bowen ratio	--	0.70
Met preprocessor: Anthropogenic heat flux	--	0.0
Met preprocessor: Fraction of net radiation absorbed at ground	--	0.15
ISC COntrol: Model options	--	DFAULT CONC DEPOS DDEP WDEP DRYDPLT WETDPLT URBAN
ISC COontrol: Averaging times	--	1 ANNUAL
ISC COntrol: Terrain heights	m	ELEV
ISC SOurce: Location	m	UTM coordinates (NAD-83)
ISC SOurce: Base elevation	m	(Above mean sea level)
ISC SOurce: Emission rate	g/s	1.0
ISC SOurce: Particle diameter	µm	1.0 (or use stack test data)
ISC SOurce: Mass fraction	--	1.0 (or use stack test data)
ISC SOurce: Particle density	µg/m3	1.0 (or use stack test data)
ISC SOurce: Scavenging coefficients	1/(s-mm/hr)	Liquid: 0.45E-04; Ice: 0.15E-04
ISC SOurce: Source groups	--	ALL
ISC TG: Terrain grid	--	Special terrain grid array not used (terrain elevation at each grid location entered in Receptor pathway)

Notes:

--	Unitless	1/(s-mm/hr)	Inverse of (seconds-millimeters/hour)
g/s	Grams/second	µg/m3	Microgram per cubic meter
m	Meter	µm	Micrometer
		yr	Year

Exhibit A-7. Risk Summary for Nederland Neighborhood by Contaminant		
Contaminant	**Port Neches/Nederland Neighborhood**	
	Average Risk	**Hazard**
Benzene	9×10^{-6}	NC
1,3-Butadiene[(a)]	**5×10^{-4}**	NC
1,3-Butadiene[(b)]	7×10^{-6}	**1**
Ethylene Oxide	**2×10^{-5}**	NC
Formaldehyde	5×10^{-6}	0.0
Benzo(a)anthracene	9×10^{-6}	NC
Benzo(a)pyrene	**3×10^{-5}**	NC
Benzo(b)fluoranthene	9×10^{-6}	NC

Notes:

[(a)] Risk values calculated using what was the current unit risk factor contained in EPA's Integrated Risk Information System (IRIS).

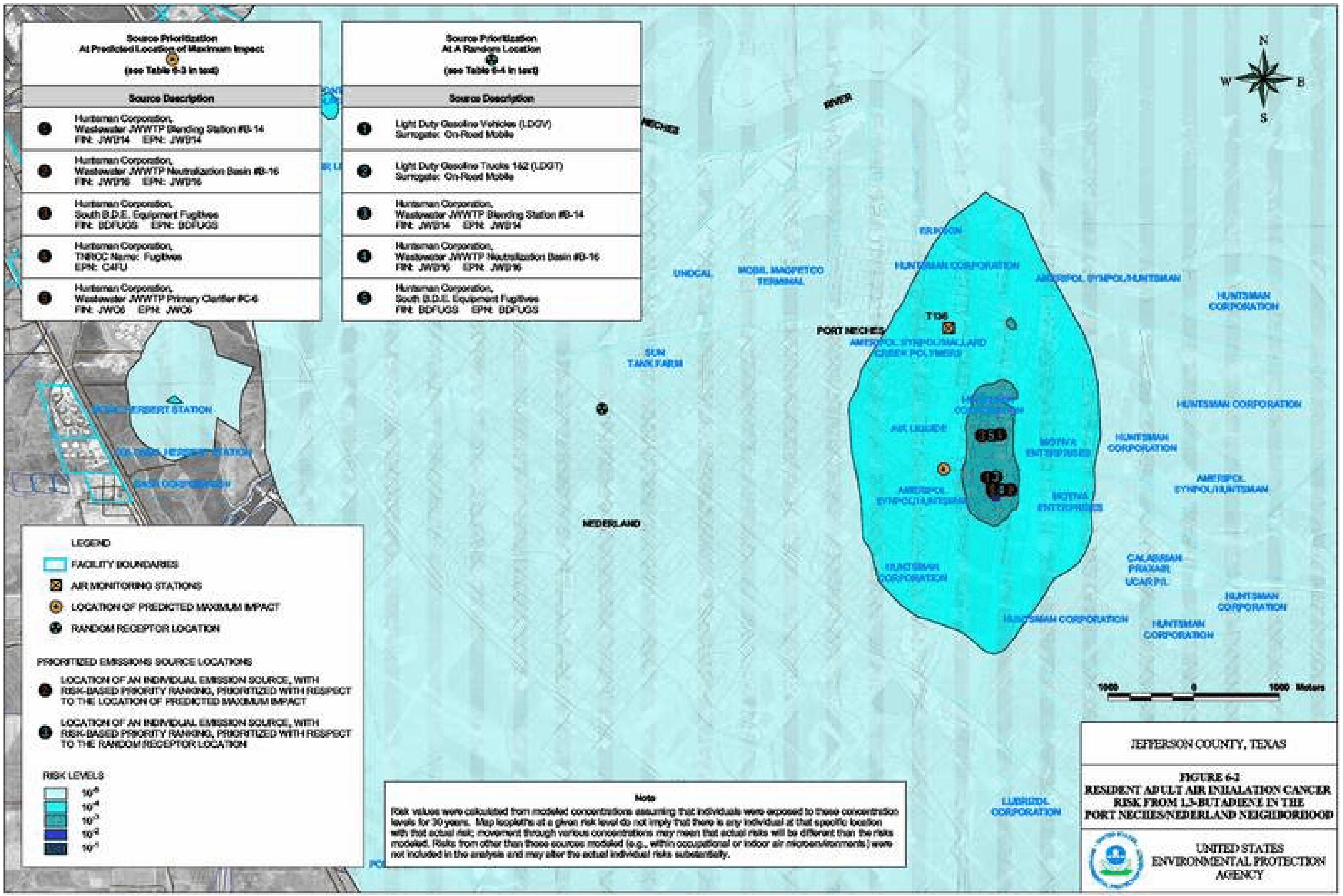
[(b)] Risk and hazard values calculated using what had been proposed toxicity benchmarks as recommended by EPA's National Center for Environmental Assessment.

The use of multiple toxicity values for 1,3-butadiene in this case study illustrates an example of what the analyst may want to do when multiple or proposed toxicity values are available. Assessors should note that the original case study materials for the Port Neches area provided on the RAIMI website (and reprinted here) are indicative of toxicity values that were available at the time and, in some cases, differ from those currently recommended by Volume 1 of this series. When performing an actual assessment in a community, EPA recommends that assessors follow the current guidelines for inhalation exposure assessment, risk calculations, and toxicity values as provided in ATRA Volume 1. While the RAIMI software has subsequently been modified to match the recommended risk calculation approaches recommended in ATRA Volume 1, the toxicity values in the RAIMI software currently do not match those recommended in ATRA Volume 1. Analysts can modify the toxicity values for a given RAIMI software run as needed to match the current recommended EPA values. EPA's current list of recommended toxicity values are provided at: http://www.epa.gov/ttn/atw/toxsource/summary.html.

NC = Not calculated.

Bold type indicates risk greater than 1×10^{-5} or hazard greater than 0.25, the limits used in this particular pilot study to identify risk drivers.

Exhibit A-8. Graphic Illustrating Geographic Areas Where Cancer Risk Estimates are Within Specified Ranges



Description of Exhibits A-9 through A-11: Illustration of Results from a Source Apportionment Analysis

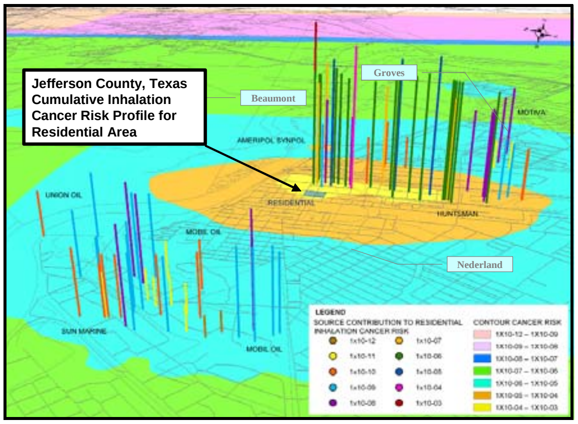
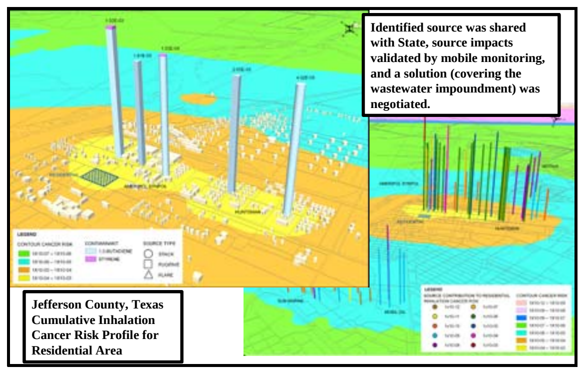
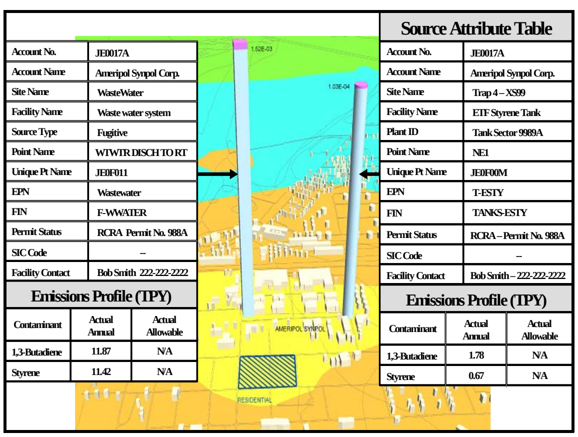


Exhibit A-9 is an example of how RAIMI can display results of a source apportionment analysis. Each bar represents a source, with the height of the bar proportional to the amount of air toxics it emits. The color of a bar represents the incremental inhalation cancer risk due to emissions from that source to residents of the indicated residential area. Shaded isopleths on the surface indicate the cancer risk to residents in each area due to the cumulative effect of all the modeled sources.

Exhibit A-10 presents a closer look at the five sources causing the highest cancer risk impacts for the modeled residential area. The height of each bar represents the cancer risk attributable to that source, and shape of the bar indicates which type of source it is (i.e., stack, fugitive, or flare).





Account No.	JE0017A
Account Name	Ameripol Synpol Corp.
Site Name	WasteWater
Facility Name	Waste water system
Source Type	Fugitive
Point Name	WTWTR DISCH TO RT
Unique Pt Name	JE0F011
EPN	Wastewater
FIN	F-WWATER
Permit Status	RCRA Permit No. 988A
SIC Code	–
Facility Contact	Bob Smith 222-222-2222

Emissions Profile (TPY)

Contaminant	Actual Annual	Actual Allowable
1,3-Butadiene	11.87	N/A
Styrene	11.42	N/A

Source Attribute Table

Account No.	JE0017A
Account Name	Ameripol Synpol Corp.
Site Name	Trap 4 – XS99
Facility Name	ETF Styrene Tank
Plant ID	Tank Sector 9989A
Point Name	NE1
Unique Pt Name	JE0F00M
EPN	T-ESTY
FIN	TANKS-ESTY
Permit Status	RCRA – Permit No. 988A
SIC Code	–
Facility Contact	Bob Smith – 222-222-2222

Emissions Profile (TPY)

Contaminant	Actual Annual	Actual Allowable
1,3-Butadiene	1.78	N/A
Styrene	0.67	N/A

Exhibit A-11 zooms in further to highlight the two sources whose emissions result in the highest cancer risks. Detailed information about these two sources is provided in the exhibit to aid in risk management decisions.

Exhibit A-9. Example Presentation of Source Apportionment Analysis

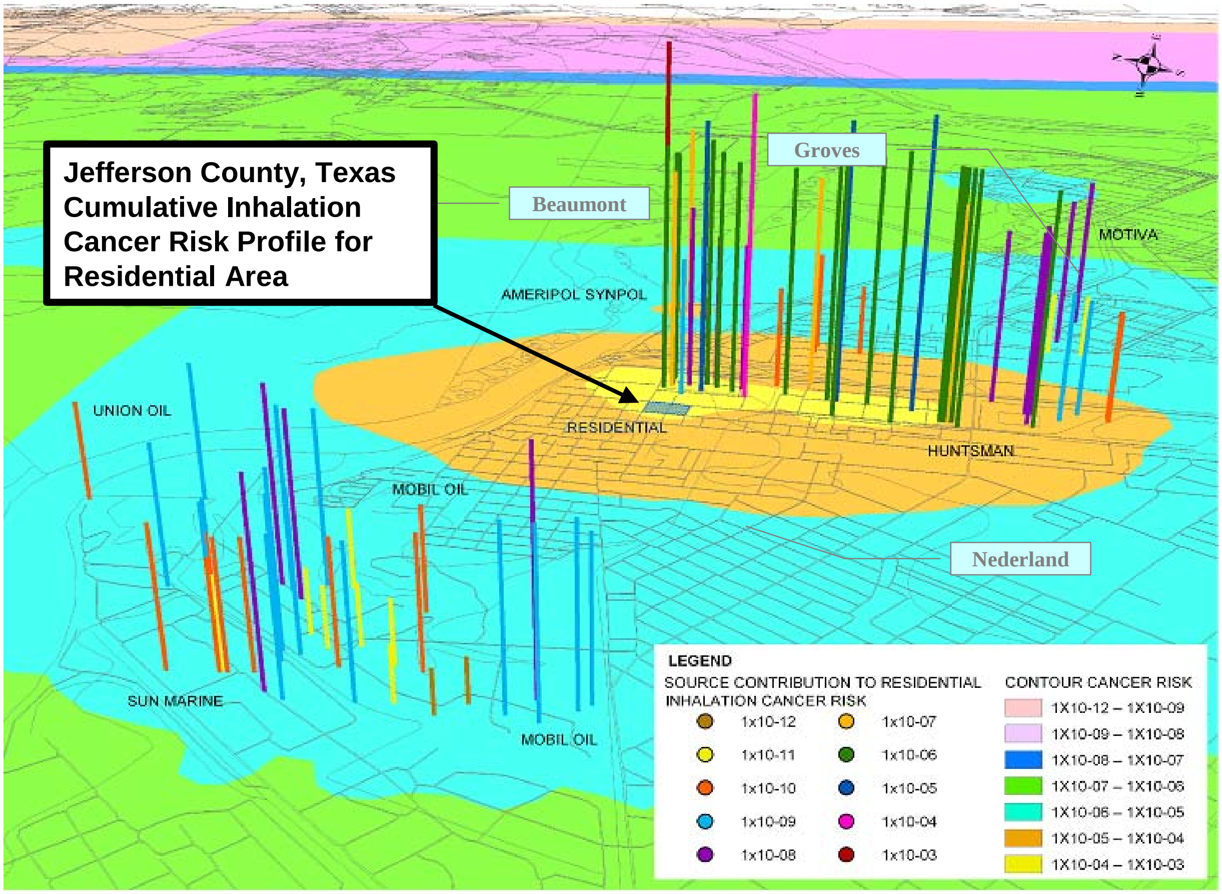
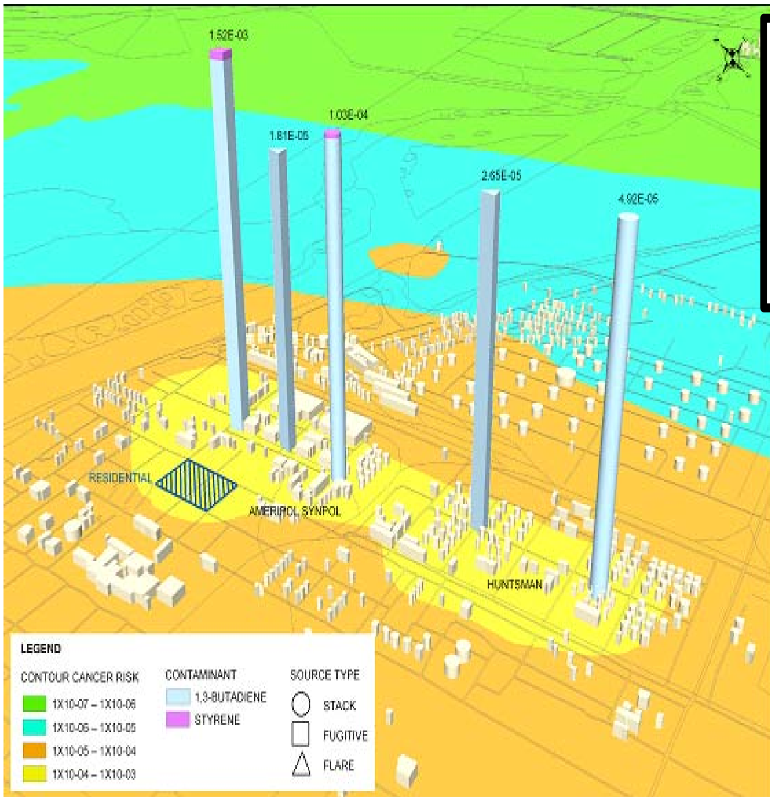
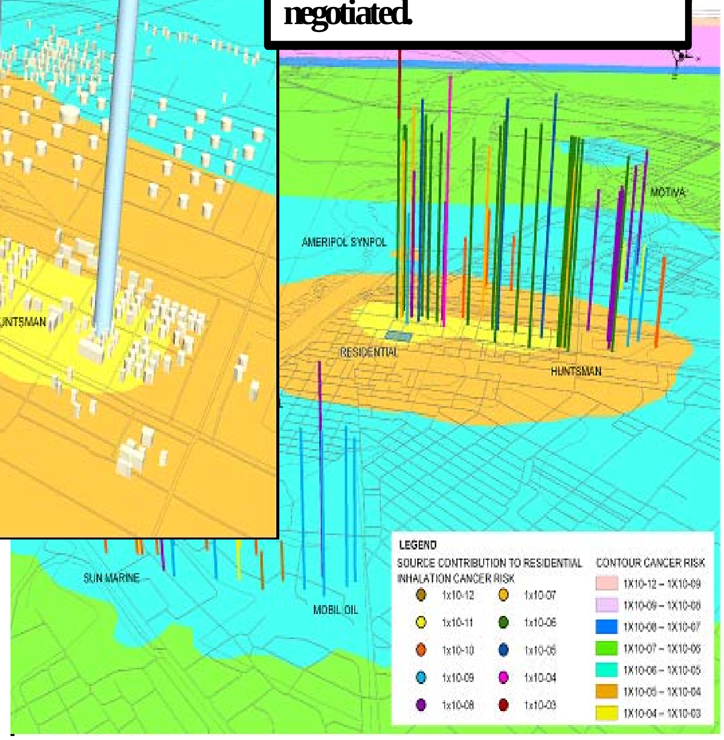


Exhibit A-10. Example Use of Source Apportionment Results



Identified source was shared with State, source impacts validated by mobile monitoring, and a solution (covering the wastewater impoundment) was negotiated.



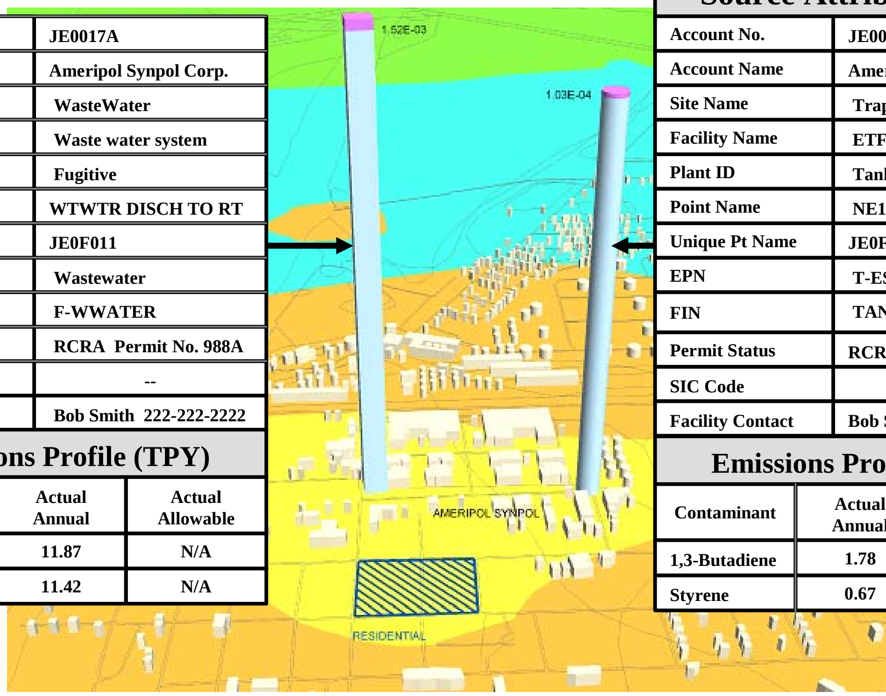
Jefferson County, Texas Cumulative Inhalation Cancer Risk Profile for Residential Area

Exhibit A-11. Example Use of Source Apportionment Results

Account No.	**JE0017A**
Account Name	**Ameripol Synpol Corp.**
Site Name	**WasteWater**
Facility Name	**Waste water system**
Source Type	**Fugitive**
Point Name	**WTWTR DISCH TO RT**
Unique Pt Name	**JE0F011**
EPN	**Wastewater**
FIN	**F-WWATER**
Permit Status	**RCRA Permit No. 988A**
SIC Code	**--**
Facility Contact	**Bob Smith 222-222-2222**

Emissions Profile (TPY)

Contaminant	Actual Annual	Actual Allowable
1,3-Butadiene	**11.87**	**N/A**
Styrene	**11.42**	**N/A**



Source Attribute Table

Account No.	**JE0017A**
Account Name	**Ameripol Synpol Corp.**
Site Name	**Trap 4 – XS99**
Facility Name	**ETF Styrene Tank**
Plant ID	**Tank Sector 9989A**
Point Name	**NE1**
Unique Pt Name	**JE0F00M**
EPN	**T-ESTY**
FIN	**TANKS-ESTY**
Permit Status	**RCRA – Permit No. 988A**
SIC Code	**--**
Facility Contact	**Bob Smith – 222-222-2222**

Emissions Profile (TPY)

Contaminant	Actual Annual	Actual Allowable
1,3-Butadiene	**1.78**	**N/A**
Styrene	**0.67**	**N/A**

3.0 The Houston Case Study for Urban Air Toxics Modeling

Another example of a multisource assessment is a modeling application completed by OAQPS for the Houston urban area. This assessment was carried out to demonstrate an air quality modeling methodology for air toxics in an urban area, highlight specific issues related to air quality modeling of an urban area, and provide an example of the application of several of EPA's publically-available air quality and emissions tools. The analysis differs from the application of RAIMI for the Port Neches case study in that it focuses on only the emissions characterization and dispersion modeling aspects of a multisource assessment and does not include any assessment of toxicity and exposure or characterization of human health risks.

For this case study, the model domain was defined to include several counties comprising the Houston urban area centered on Harris County, Texas. EPA's 1996 National Toxics Inventory (NTI) was used to compile emissions data for benzene, cadmium, chromium, formaldehyde, and lead from sources in the Houston area (i.e., all stationary and on-road and non-road mobile sources). EPA's Emissions Modeling System for Hazardous Pollutants (EMS-HAP) was used as an emissions processor to interface with NTI, perform QA/QC, and convert the NTI data into a format for ISCST3.

ISCST3 was selected as the primary air quality model for the application, and was used to calculate ambient concentrations for air toxics other than formaldehyde. For formaldehyde, two modeling steps were applied: (1) dispersion of formaldehyde emissions was modeled using ISCST3, with simple atmospheric decay accounted for by a user-supplied half-life; and (2) formation of formaldehyde from emissions of precursor pollutants was modeled using EPA's OZIPR model, a screening-level, one-dimensional photochemical box model (see http://www.epa.gov/scram001/tt22.htm#ozipr). Concentration outputs from ISCST3 and OZIPR were then added together to estimate total ambient formaldehyde concentrations. For all pollutants, census tract centroids and monitoring station locations were selected as receptor locations for ISCST3 modeling, and annual average concentrations were defined as the modeling endpoint.

Three sets of model results were generated. In the first set, the modeling was performed with all types of emissions allocated to 1-km grid cells. In the second set of results, on-road mobile source emissions were allocated to road segments in the Houston area. A third set of model runs was executed using a set of receptor locations spaced 500 m apart in one part of the modeling region containing a high density of emission sources to determine the impact of using a finer (i.e., denser) results grid. These sets of results were compared to each other and to available monitoring data.

Several conclusions were drawn from the results of the Houston case study.

- Higher concentrations were located in eastern and northern Harris County, near the higher density of emission sources for the five HAPS studied.

- Increasing the receptor density near emission sources changed the location of maximum concentrations, illustrating that concentration gradients can occur near high emission sources and highlighting the importance of receptor placement and density to modeling results.

- Allocating onroad mobile emissions to road segments can improve the model-predicted concentrations when compared to observations from monitoring data.

In addition, the authors of the study noted that refinements in the emissions inventory would aid in predicting accurate model concentrations for assessing exposure to toxic pollutants.

This case study is described in detail in the *Example Application of Modeling Toxic Air Pollutants in Urban Areas*, available at http://www.epa.gov/scram001/guidance/guide/uatexample.pdf (EPA 454-R-02-003, June 2002).

4.0 The Cleveland Clean Air Century Campaign in Cleveland, Ohio

The case study presented in this section illustrates how a community can work together to identify toxics risk factors in a community, identify issues of concern, and select and work on projects to reduce the risks posed by these factors. Although the Cleveland effort focuses primarily on air pollution issues, the approach used in Cleveland can be applied in any community to assess and address the wide array of environmental risk factors faced by the community. Several examples of other community-based projects are also summarized following this section.

4.1 Overview of the Campaign

The Cleveland Clean Air Century Campaign (CCACC) is a voluntary, community-based initiative administered by the American Lung Association of Ohio with the goal of reducing health and environmental risk from air toxics in the Cleveland area. With the aid of U.S. EPA and the City of Cleveland, the stakeholders are working together on an approach to air toxics control that serves as a model for communities nationwide. The City of Cleveland was chosen for this initiative because the area has typical levels of air toxics in both the indoor and outdoor environments, contains a local EPA Cleveland Field Office, and is home to strong community groups. More detailed information about CCACC can be found at the main web page for this project at http://www.ohiolung.org/ccacc.htm.

This partnership between the City of Cleveland and EPA was a pilot study for EPA's Community Action for a Renewed Environment (CARE) program, an EPA initiative designed to establish a series of multi-media, community-based, and community-driven projects to reduce local exposure to toxic pollution (see http://www.epa.gov/care/). CARE empowers communities by responding to their needs, helping to reduce risk, and working with them to solve problems identified within their community. The Cleveland project demonstrates this approach in which local stakeholders, with advice and support from the EPA, can work collaboratively to achieve reductions in air toxics.

Cleveland Clean Air Century Campaign Working Group Members

Environmental Groups
- Environmental Health Watch
- Cleveland Green Building Coalition
- Earth Day Coalition

Government Agencies
- Cleveland Department of Public Health, Division of Air Quality
- Ohio Environmental Protection Agency
- US Environmental Protection Agency

Neighborhoods/Citizens
- St. Clair Superior
- Slavic Village
- Lee-Seville-Miles
- Tremont
- Congressman Kucinich's Office

Indoor Sources
- Schools
- American Lung Association of Ohio

Stationary Sources
- Goodrich Landing Gear
- RPM
- Northeast Ohio Regional Sewer District
- City of Cleveland Division of Waste Collection & Disposal
- Alcoa

Mobile Sources
- BP Products North America Inc.
- Regional Transit Authority (RTA)
- Northeast Ohio Areawide Coordinating Agency

Other
- Cuyahoga Community College

Under the CCACC, community members have collaborated to implement measures designed to reduce exposure to air toxics from important outdoor and indoor sources. The methods employed in implementing these measures and a description of some of the results achieved under CCACC are described below.

4.2 Goals and Organization

The CCACC was initiated in March 2001 with three primary goals:

- Reduce air toxics in Cleveland within a year;

- Ensure the project is sustainable over time within the community; and
- Ensure the approach can be replicated in other counties across the United States.

A central component of this campaign was the creation of a **Working Group** comprised of representatives from a range of interested neighborhoods, organizations, businesses, and government agencies to guide the campaign. Members of the Working Group are implementing projects to reduce air toxics in Cleveland. These projects address pollutants from many sources, both indoors and outdoors, and put into place an innovative risk reduction program in the city to help address important urban toxic air pollutants. The project also includes an evaluation of the overall process to help improve the ongoing project as it moves forward and to capture key lessons and findings to ensure the success of future projects in other cities.

4.3 Consideration of Air Toxics Risks

The project plan for this initiative recognized the role of data analysis to identify candidates for risk reduction; however, given the goal of implementing air toxics reduction actions within a year of initiation, there was commitment to a streamlined assessment process. This objective for the streamlined assessment was to help identify a set of "risk-drivers" for air toxics in Cleveland to inform reduction action decisions that would benefit Cleveland.

A report was prepared by the consultant early in the project that examined available studies and information on air toxics pertinent to Cleveland for both indoor and outdoor sources and arrived at several preliminary findings regarding this short list of air toxics of concern. This early information, accompanied by presentations and discussions on this and on basic air toxics and risk concepts and methods, allowed the stakeholder group to quickly move from a focus on information and analysis to consideration of air toxics projects and actions.

4.4 Exposure Reduction Projects and Results

In March 2002, the CCACC Working Group identified and selected the first set of projects to be undertaken in reducing exposure to air toxics in the Cleveland area. These reduction projects targeted a range of sources, including indoor and outdoor sources, mobile and stationary sources, and air toxics produced by industrial and non-industrial (e.g., domestic) sources. Projects were also initiated that were designed to increase awareness and/or acquire additional knowledge regarding exposures to air toxics in Cleveland. Risk reductions were underway and making a difference in Cleveland by the summer of 2002.

Exhibit A-12 provides descriptions of the projects currently under way in Cleveland as a part of the Campaign and notes selected accomplishments associated with some projects (costs associated with some of these projects are provided in Section 8.3). It is important to note that while aspects of CCACC projects benefit Cleveland as a whole, the Campaign has focused

Exhibit A-12. CCACC Risk Reduction Projects	
Project	**Description and Selected Results**
Smoke-Free Home Pledge Campaign	Encourage people to designate their homes and automobiles "Smoke-Free." This campaign is designed to protect children as well as adults from the health risks of secondhand smoke. ***Result*:** Smoke-free home pledges from 251 families.
Highway diesel fuel for off-road use	Reduce emissions of diesel particulate matter by encouraging low-sulfur fuel use as part of major construction contracts and increase community knowledge about options for reducing emissions from diesel vehicles. If all off-road equipment switched to highway-grade diesel fuel, there would be an approximate particulate matter (PM) emission reduction of 13%, or 80 tons. ***Result*:** For only construction equipment with 20% participation, the reduction is approximately 10 tons, or 2.5 lb of PM eliminated per 100 gallons of fuel, or for every 100 hours of use.
Anti-idling campaign	Eliminate unnecessary vehicle idling throughout the City of Cleveland by both private citizens and business/public fleets by achieving widespread recognition that avoiding idling is a smart, effective, accessible, immediate, and money-saving way to reduce pollution including air toxics. ***Result*:** The institution of the Cleveland Municipal School District Anti-idling Campaign. Vehicles departing from all school garages are restricted to the maximum of five minutes of running time after vehicle start up.
Cleaner Diesel Fleets for Cleveland	Reduce emissions of diesel exhaust, reduce school children's exposure to diesel exhaust, and increase community knowledge about options for reducing emissions from diesel vehicles by providing funding to fleets for retrofitting vehicles. ***Result*:** Catalyst mufflers installed on 29 Cuyahoga County Board of Mental Retardation & Developmental Disabilities buses, and three new engines installed in City of Cleveland Heights vehicles. These technologies reduce particulate matter by 20-50%, carbon monoxide by 40%, and hydrocarbons by 50%. In addition, 23 (out of 600) school buses in the Cleveland Municipal School District (CMSD) were upgraded with new particulate filters. This technology reduces emissions of particulates, hydrocarbons, and carbon monoxide by 90% when used in conjunction with ultra-low sulfur diesel fuel. CMSD was awarded a U.S. EPA "Clean School Bus USA" grant; the Ohio EPA redirected secured funds to support the District's retrofit project for an additional 41 school buses.
Cleveland local emission source inventory	Develop local inventory of emissions of priority air toxics. ***Result:*** Developed a cost-effective, reliable, baseline inventory for individual sources of risk driver hazardous air pollution (HAP) emissions in and around the Cleveland area.

Exhibit A-12. CCACC Risk Reduction Projects	
Project	**Description and Selected Results**
Gas Can Exchange Program	Reduce toxic air emissions caused by residential/facility usage, storage and /or improper disposal of gasoline. ***Result*:** CCACC funded the replacement of older cans with 656 5-gallon and 368 2.5-gallon lower-emission cans. The estimated potential reduction of VOCs for all of these cans over their five-year functional life span is 10.6 to 18.5 tons. The corresponding estimated benzene reduction is 420 to 720 lb.
Household Hazardous Waste (HHW) Collection/Exchange	Reduce toxic air emissions caused by residential usage, storage and/or improper disposal of hazardous household products by coordinating HHW collection events. ***Result*:** CCACC coordinated two household hazardous waste (HHW) collection events. In 2002, 8.38 tons of HHW were recycled and 12.7 tons of waste was collected from 88 households, with a total reduction of 270 grams of mercury. In 2003, 117 households participated and 13.59 tons of HHW were collected.
Electroplating toxics emissions reduction	Provide information and resources to local electroplaters to manage and reduce toxics. ***Result*:** CCACC funded an electroplater workshop that gives local electroplaters the information, skills, and resources to manage and reduce toxic emissions.
Tools for Schools	Provide schools with information, skills, and equipment/materials to manage air quality in a low-cost, practical manner. ***Result*:** CCACC funded Tools for Schools assessments for 4 Cleveland schools and held Tools for Schools training workshops for 98% of the building maintenance personnel. In addition, CCACC funded the purchase of equipment/materials for the improvement of indoor air quality in 48 schools and a Healthy Indoor Air In Schools workshop for 50 environmental health professionals.
Commuter Choice	Address emissions from mobile sources incurred through commuting practices. ***Result:*** Employers are encouraged to offer incentives for carpooling, public transit, and other environmentally-friendly commuter options.
RTA Bus/Fuel Replacement	Address unhealthy emissions from older commuter buses. ***Result:*** Replaced older circulator buses for St. Clair/Superior and Slavic Village neighborhoods with new buses and fuel for low-sulfur diesel.

Exhibit A-12. CCACC Risk Reduction Projects	
Project	**Description and Selected Results**
Home Indoor Air Education Campaign	Provide information to citizens regarding indoor air quality. ***Results:*** Created the "Home Air Pollution Resource Guide" (a 21-page home indoor education booklet) for Cleveland residents that provides educational information and resources on indoor air quality (IAQ) issues. Disseminated 4,000 home indoor air education booklets. Expected results include potential risk reduction from lead and mold, increased awareness and knowledge of IAQ issues, and less improper disposal of household hazardous waste in landfills or sewers.

particular attention to the St. Clair/Superior Slavic Village, Tremont, and Lee-Seville-Miles neighborhoods of the City, so that the Working Group can more easily measure progress and target local resources. These neighborhoods were selected because they met criteria developed by the EPA in conjunction with the City, such as a diverse mix of industry and sources, a significant amount of residential housing, and active community groups. It is hoped that the initiatives begun in these areas will be undertaken in other Cleveland neighborhoods.

5.0 Additional Examples of Community-Based Projects

In this section, three additional examples are presented that are similar to the Cleveland campaign. Each of these illustrates community-based action toward reducing exposures and risks from air toxics and other pollutants.

5.1 Multi-Media Toxics Reduction Project – South Phoenix, Arizona

The Arizona Department of Environmental Quality (ADEQ) was awarded an EPA grant to build on the success of the Cleveland project (discussed above) to reduce toxic pollutants in South Phoenix. The purpose of this project is to develop and implement a plan to reduce air, water and soil pollution and improve public health in the South Phoenix community. The project will identify sources of toxic pollutants, analyze those source contributions and their potential health and environmental effects, and develop a prioritized action plan to lower public exposures to these toxics substances. The project will also require an extensive communication and public outreach effort.

Some of the steps that are being taken include:

- Convening a Community Action Council (CAC) to oversee the process;
- Review of historical and current data to identify problematic toxics;
- Select the pilot area for the analysis;
- Develop science-based strategies to reduce public exposure; and
- Implement the strategies.

The organization of the CAC includes a wide variety of members chosen to reflect the diversity of the community, to serve as liaisons to their constituent groups, and to participate in the decision making process. The process is structured to be open and inclusive with access to the advice and technical expertise of persons knowledgeable about environmental issues (including federal, state, and local government authorities). The CAC is working to emphasize a facilitated consensus-based process that is reflective of the diversity of community's views. More information about the South Phoenix project can be found at: http://www.azdeq.gov/function/about/spco.html and http://yosemite.epa.gov/oar/CommunityAssessment.nsf/0/bfdaf1b8469667ec85256c6e005c79cb?OpenDocument.

5.2 The Chelsea Creek Action Group Comparative Risk Assessment – Chelsea and East Boston, Massachusetts

The Chelsea Creek Action Group (CCAG) is a coalition of Chelsea and East Boston residents, led by the Chelsea Green Space and Recreation Committee and the East Boston Neighborhood of Affordable Housing. Together, CCAG members on both sides of the Creek work to gain access to the waterfront, to get land owners to remediate contaminated land, and to help residents appreciate the value of this natural resource. CCAG works to connect the two communities through newsletters, events and fairs, environmental workshops, boat tours, and walks.

As part of their efforts, the CCAG is working to perform a comparative risk assessment for the local area. The Comparative Risk Assessment has three interrelated goals:

- To collect information from Chelsea and East Boston residents on their greatest environmental and health concerns stemming from activities along Chelsea Creek;
- To collate the scientific data on the environmental hazards present in and around Chelsea Creek; and
- To create a way for neighbors, agencies, and government to work together and create action plans to tackle those problems.

As a first step, a Resident Advisory Committee solicited input on environmental and health concerns from residents on both sides of Chelsea Creek. By holding public meetings and conducting surveys, the Committee found that people's top environmental concerns are:

- Air quality and respiratory illnesses;
- Water quality in Chelsea Creek; and
- Truck traffic and noise.

In response, the CRA Technical Committee is gathering and processing scientific information about those concerns. The Committee is composed of scientists, public health professionals, attorneys, and other concerned people. At the end of the study, the Committee will write a report that will guide public policy in the community. To learn more about the Green Space and Recreation Committee and their efforts, see http://www.chelseacollab.org/greenspace/.

5.3 Air Toxics/Environmental Justice Pilot Project – West Oakland, California

The goal of this project is to work with the community and other stakeholders to identify and implement reductions in air toxics in West Oakland. While the initial core of the project is assessment of the impacts of, and mitigation measures for, diesel truck emissions, the scope is expanding to multi-media. The community has identified specific needs in the following areas:

- Red Star Yeast;
- Air monitoring;
- Community health assessment;
- Asthma center;
- Truck/diesel relief;
- Clean-up of a Superfund site;
- Indoor and school air quality; and
- Transit and access issues.

The approach of the project is based on the following tasks:

- Build on the community's ongoing work, which has identified key indicators and a comprehensive list of desired solutions;
- Work with the community and other key stakeholders (the city, city council, Port of Oakland, the county) and state and local partner agencies to assess the problems, refine the issue list, identify solutions and facilitate their implementation; and
- Identify potential EPA points of access to these issues and solutions and integrate EPA's programs and available tools.

More information on the West Oakland project can be found at: http://yosemite.epa.gov/oar/CommunityAssessment.nsf/d2cea01886a35f4085256e1900591902/6d201b0c720741fd85256c6f005d91c4!OpenDocument.

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